Furthermore, rhythmic speech units could be potentially used as tools to measure variations on rate and rhythm, by obtaining measures of interstress intervals for rate, and relative timing between components as a measure of rhythm. The critical relative timing between components will be influenced by the nature of rate reduction strategies empolyed. Syllable prolongation or talking to a rhythm or syllable timing are more likely to disrupt this critical timing between components, consequently affecting the rhythm of speech. Then, by restoring normal trends in rate variation for rhythmic units, it may be possible to restore the critical timing between components.

One rate reduction strategy that should be considered is the use of durational cues for establishing stress contrasts within the context of rhythmic units. From the results of the present study, it seems reasonable to expect the maintenance of fluency, rhythm, and rate, at least for rhythmic units that are relatively more frequent in English. At this point, these notions on therapeutic strategies for the maintenance of fluency, rate, and rhythm are speculative and needs to be substantiated by future research.

It is likely that, while some stutterers may be able to maintain a close to normal rhythm, fluency, and rate, at least for shorter temporal units, there may be some stutterers for whom this balance may be difficult to achieve.

This point is further clarified upon scrutiny of the values obtained from individual subjects for SVs and the 1USVs. For the first unstressed vowels, three subjects in the group of stutterers differed from the group trend. This suggests that these subjects did not effectively use rate control strategies or did not plan their units in terms of rhythmic units. The latter speculation is rejected because these subjects did show temporal compression of SV as a function of foot size. Therefore, it is more likely that they failed to use the mechanism of rate control as effectively as others. For stressed vowels, one normal subject and one stutterer differed from their group trends. These two subjects showed a slight increase in the duration of stressed vowel for the five syllable unit instead of compression. The five syllable unit as indicated earlier is not a frequently occuring unit in English and therefore the inconsistency shown by these two subjects may be due to unfamiliarity in temporally planning longer units.

It is relevant here to briefly reexamine a study done by Shapiro (1970) which was recently reviewed by Wingate (1982). Shapiro reportedly used 15 male and 15 female

stutterers, and used intensity as a measure for comparing stress patterns of several brief utterances of stutterers and normal speakers. The curve for each utterance was plotted with amplitude in the x axis and the time in the y axis. The results showed that stutterers showed increased amplitude for the initial stress, but subsequently the curves showed a rapid decay. Also, temporally, the first stressed pulse was influenced by the length of the intended utterance.

On examining the utterances used by Shapiro (seen in Wingate, 1982) in terms of the rhythmic units, as defined in the present study, the longer utterances (from four to five syllables) are rhythmically different from the three syllable utterances. Examples of four and five syllable utterances are, "Thug has six legs" and "The cat's name is Tom". A three syllable utterance is, for example, "Rex chased Tom". While the three syllable utterances have three successive stresses, the four syllable utterance has an alternating stress pattern for the first three syllables, and the last two syllables are successively stressed. The five syllable utterances begin with an unstressed syllable. Wingate noted that the curves for the three syllable utterances for stutterers were similar to normals, and that the differences in curves were more apparent for the four and the five syllable utterances. A reinterpretaion of these findings in terms of rhythmic units as used in the present study would suggest that the equal stressedness that is required for the three syllable utterances in question is likely to result in isochronous timing, and therefore would be more similar to syllable timed speech, which stutterers would have practiced in their therapeutic programs. The increased amplitude and temporal displacement for longer utterances seems to be due to imposing stress on the initial syllable which should in fact be unstressed. This indicates a lack of variation in stress contrasts, and is likely to be evident temporally. This in turn will result in deviations from the normal trend in terms of temporal compression, rate, relative timing of components, and thus, the overall rhythm of speech.

F. Implications for a Timing Model

The issue discussed so far should be viewed in the light of some of the existing models of speech timing to explain temporal organization of rhythmic units. The significant findings on temporal compression, expansion, and rate within rhythmic units strongly support the notion that temporal organization of speech occurs in terms of rhythmic units.

thus supporting an open loop, (comb model) system of Kozhevnikov and Chistovich, (1965), as opposed to a closed loop (chain model) system. Although Kozhevnikov and Chistovich based their model on their findings on Russian, the results of the present study are very similar to those reported by the Russian researchers. In particular, variations in durations of individual components occurred within the unit, but there seemed to be a certain temporal invariance in terms of relative timing between components. The similarities between stutterers and normals for relative timing for a given sized unit, and in particular, the temporal invariance seen for normal speakers for RUSS, support the notion that successive syllables within a rhythmic unit are preplanned.

Although these findings are in support of an open loop model, they do not support the isochrony hypothesis according to which interstress intervals would be of equal duration. In contrast, temporal compression was seen in some components as a function of foot size.

Besides providing substantial evidence in support of the comb model, the findings of the present study are significant in understanding how rate and rhythm are regulated within rhythmic units. The interactions between the temporal regularities observed within the rhythmic units led to the consrtuction of a possible model of speech timing.

A possible model of speech timing is illustrated diagramatically in Fig. 5.1. This model is mainly proposed to explain the rate control mechanism that was observed, and in the hope of spurring experimental interest in rate and rhythm.

According to this model, the unit of planning is a rhythmic unit, which to some extent is determined by the production and processing constraints, which also influence the structure of the language. The size of the unit planned, and the output should also meet the limits set by the processing and production mechanisms. Therefore, for longer units, rate increases occur and this is governed by certain speech timing rules, which regulate the compression of selected components. However, due to the limitations imposed by the production and processing mechanisms, the magnitude of compression is regulated. The effects of compression are also counteracted by the temporal expansion of selected components. This interactions between temporal compression and expansion governed by relative timing rules result in rate modulation. These three timing rules, i.e., selective compression, selective expansion, and relative timing are considered language specific

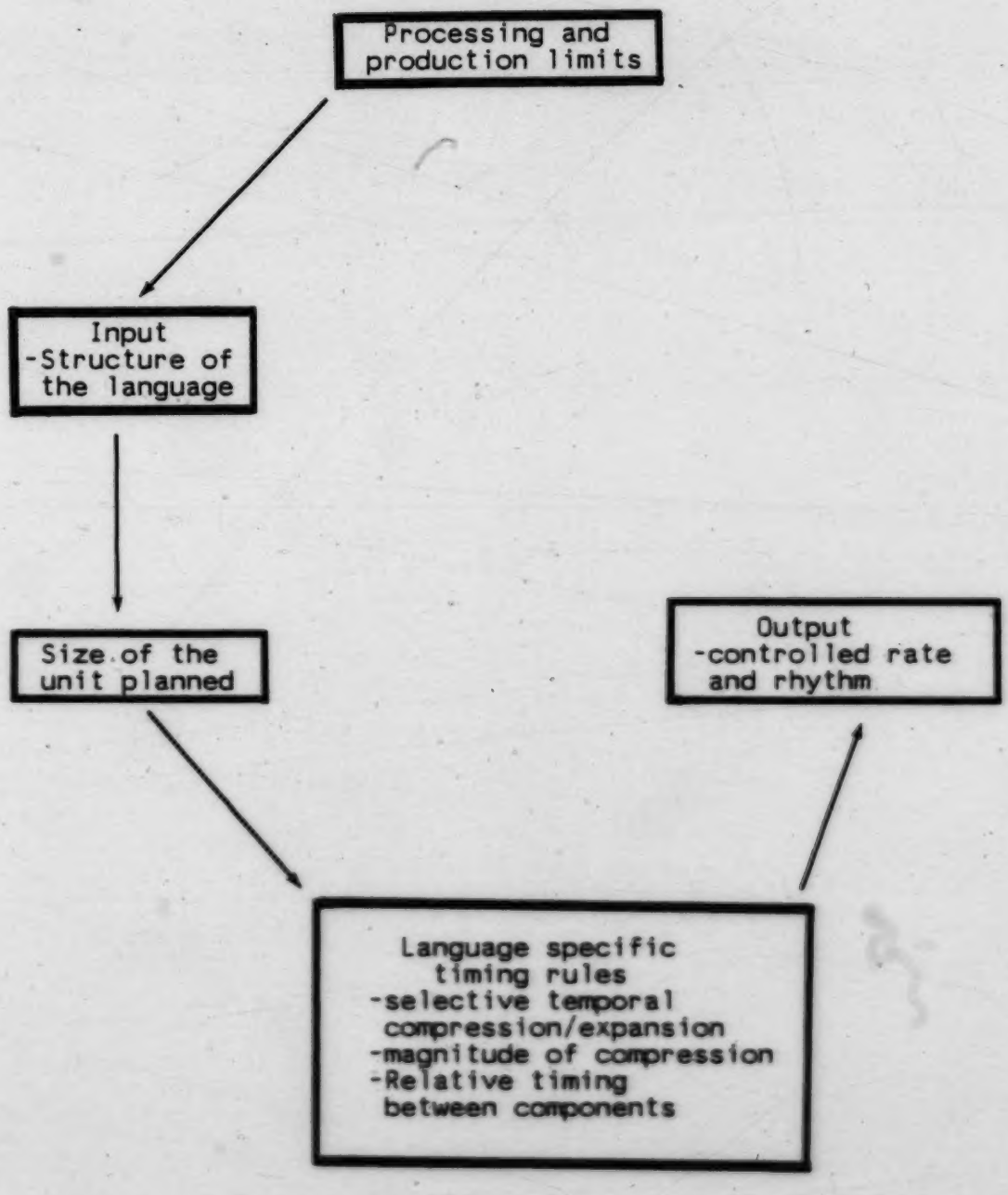
Processing and production limits
Input -Structure of the language
Size of the unit planned
Output -controlled rate and rhythm
Language specific timing rules
-selective temporal compression/expansion
-magnitude of compression
-Relative timing between components

Figure 5.1 A possible model of speech timing.

timing rules that operate within the constraints of the processing and production mechanisms

This model has similarities with Lashley's model in that, various factors illustrated in the model are interacting and interdependent. The role of feedback, however, still not known. In particular, we need to seek answers to questions such as how a speaker knows that the magnitude of compression and thus rate falls within the temporal limits of processing, or is it the physiological limitations of the speech mechanism that determines the extent of compression? Port (1981) maintains that physiological restrictions on articulation do not manifest themselves as a kind of output constraint. He argues that the extent of compression he found in his study are not likely to be the physiologically minimum duration that speakers are capable of producing. The extent of compression is then, perhaps governed by language specific relative timing rules. Finally the question is, what guides the speaker in maintaining a certain relative timing between components of a given unit? The speculation is that these language specific timing rules are similar to phonological rules a speaker has acquired as part of language acquisition. The feedback is then external and comes from the listener. If the listener indicates processing difficulties, then the speaker is likely to choose a different set of words, rephrase, and thereby alter the rhythm of a unit and possibly the rate as well.

This possible model is by no means complete, and does not intend to cover all aspects of speech timing in the regulation of rate and rhythm. It is merely a skeletal framework for a potential model, which requires future validation.

VI. CONCLUSIONS AND IMPLICATIONS

In this chapter the conclusions of this study and the implications it holds for research will be presented.

A. Conclusions

The present research showed no evidence in support of production isochrony, although the results supported the notion the speech units are preplanned in terms of rhythmic units (interstress intervals). Thus supporting an open model of speech timing , specifically the comb model, as opposed to a closed loop model.

In order to explain the various interacting and interdependent factors observed within the rhythmic units in this study, a possible model of speech timing is proposed.

According to this model, it is the temporal limits of processing that determine the size of the unit planned, thereby, motivating rate increases. However, this rate increase reaches a plateau, possibly due to the limitations of the production and processing mechanisms. While the temporal compression of IVI, SV, and 1USV results in rate increase, this compression is counteracted by the temporal expansion of the unstressed vowels. This compression and expansion of selected components results in the stabilization of rate. For normal speakers, any rate decrease seem to result from temporal expansion of selected components rather than the reduction in compression, thus suggesting that certain rules operate within a planned unit. Moreover, the rate control mechanism also interacts with certain relative timing rules that operate to maintain a critical relative timing between components. Thus, changes in rate do not occur as linear transformation of all the components within a planned unit.

It is speculated that the selective compression and expansion of components and the relative timing are specific timing rules that regulate rate and rhythm of speech. In essence, the rate control mechanism then, will not only operate within the limits set by the production and perception mechanisms, but also by the dictates of certain language specific relative timing rules.

The similarities in the operation of these timing rules for both stutterers and normals and the observations from the auxiliary experiment further confirm that selective

compression, expansion, and relative timing are speech timing rules of English and that these rules interact with each other to produce the desired rate and rhythm.

Although the group of stutterers used in this study showed temporal regularities similar to normals, the breakdown in temporal regularities that occurred for the longer units for stutterers suggests that stutterers are likely to have greater difficulty planning and executing longer units while maintaining fluency, desired rate, and rhythm. Stutterers perhaps have to compromise on rate and relative timing, i.e rhythm, in order to maintain fluency.

The three factors, temporal compression, expansion, and relative timing that have been identified as parameters of speech timing rules, offer some specific parameters for the study of rate and rhythm. Future investigations are warranted to study the interactions of factors governing rate and rhythm both in stutterers and in normal speakers. For instance, the relationship between coarticulation and relative timing needs to be examined.

Furthermore, since the present study has provided evidence for rhythmic units as units of temporal planning, there is a great potential for the use of rhythmic units with stutterers and other prosodic disorders for facilitating fluency and normal rhythm. These issues which have significant clinical implications need to explored systematically.

Finally, the rate control mechanism described here was designed to explain the observations of interactions and interdependencies of components within rhythmic units. This is merely a skeletal framework for a potential model of speech timing and needs to be substantiated by future research.

B. Research Implications

The present study has raised some interesting speculations regarding the rhythm of speech in normal speakers and stutterers alike. An attempt is made to enumerate all the possible issues that warrant future investigation, although some of these issues have been mentioned in the course of the discussion.

Temporal Issues in Normal Speech

Timing model: The possible model described in this study to explain regulation of rate and rhythm should be substantiated through perception studies as well. The relevance of temporal compression, expansion and relative timing can all be studied through careful manipulation of the speech signals and listeners' judgement can be obtained on the temporally modified signals.

Unit of planning: Some of the possible studies in understanding interstress interval as a unit of planning and/or processing in normal speakers are discussed in this section.

Although, in this study, evidence was presented in support of rhythmic unit as a unit of planning it was also noted that temporal processing constraints are likely to determine the size of the rhythmic units in a language, the duration of the most frequently occuring foot size is likely to be the preferred duration for speakers of a given language. This notion is purely speculative and we need to seek empirical evidence to find out whether or not the unit for processing is universally constrained temporally, or whether a speaker of a given language is somehow conditioned to plan and produce a unit of a certain magnitude more efficiently than others. In other words, do speakers of different languages have different preferred durations for planning and producing a speech unit?

Perceptually, the significance of the rhythmic unit as a unit of processing can be determined using an experimental paradigm similar to that used by Kozhevnikov and Chistovich (1965). These researchers reported on listeners' performance in recognizing filtered sentences as a function of number of syllables. A study of listeners' performance on recognition of filtered speech by controlling for number of syllables and for the size of the rhythmic units, will reveal whether the rhythmic unit or the temporal processing limit is critical in determining the unit of processing. It is possible that significant interactions of limits in processing and the size of the rhythmic units are likely to occur. It is also possible that longer rhythmic units, despite their size, may still be recognized by listeners with greater accuracy than longer utterances made up of several syllables, of equal length. Such a finding would then confirm the importance of rhythmic units in processing and planning, perhaps due to their stress syllables that carry high information value.

Temporal compression: An important observation that led to the hypothesis of rhythmic

unit as a unit of planning was the temporal compression of SV, 1USV, and IVI as a function of foot size. At the same time it was also observed that the rate of speech also increased as a function of foot size up to a certain point. The relation between magnitude of compression and rate needs to be investigated. The question is, supposing the stressed vowel and the first unstressed vowel which normally seem to undergo temporal compression attain a limit and cannot undergo compression any further, do other components of speech in a rhythmic unit undergo temporal compression to achieve a target rate? Apart from the theoretical interest in answering such a question, there are some practical applications. For instance, a synthesized unit of speech will perhaps be judged as being more natural or acceptable if it is compressed in accordance with the natural rules, compared to the overall compression of a speech unit. This question is particularly important in the light of our finding with regard to critical timing relations between components in a rhythmic unit.

Relative timing: The significance of relative timing needs to be verified through perceptual experiments. An useful experimental paradigm would be to obtain listener judgements of speech that have altered temporal ratios between its components.

Another speculation that grew out of the finding on critical relative timing is that it is this certain predetermined durational ratio between the components of a speech unit that determines the rhythm of a language. Using speakers of different languages, we can verify whether or not speakers maintain similar ratios for nonsense units regardless of their relative timing in their respective languages. If they maintain similar ratios regardless of their languages, then relative timing is likely to be determined by the phonological make up of a production unit. On the other hand, if speakers of different languages show critical timing within components of nonsense unit similar to the timing relations in their native tongue, then we could infer that the critical timing determines the rhythm of a language, which speakers are likely to carry over to nonsense units as well.

The observation on relative timing of components of a speech unit has stirred yet another possibility for future investigation. The lack of "naturalness" of synthesized speech comes from the concatenation of speech segments. If a provision is made to adjust the syllabic durations, then by altering the durations of syllables, a critical relative timing could

be established which in turn is likely to result in synthesized speech utterances that are likely to resemble natural speech. This notion of adjusting durations to match an inner temporal criteria is not new. Nooteboom (1975) used a method of adjustments using synthesized speech segments in a perceptual experiment. He asked subjects to adjust the duration of synthesized vowels in a word in such a way that the word as a whole sounded as natural as possible. A desired stimulus was synthesized repeatedly and the duration of one acoustic segment of the word was contiuously adjusted by means of a knob. A very important application of this duration adjustment feature would be for communication aids that use synthesized speech. With our present findings on the significance of relative timing between components, by adjusting the durations of the components of speech, it would be possible to produce utterances which would perhaps have a rhythm that simulates natural speech. While it may not be practical to expect users of communication aids to have the linguistic intuition or the physical capabilities to make these temporal adjustments, it is, however, possible for trained clinicians to make these durational adjustments in these aids that have provision for storing programmed utterances.

Research Implications on Stuttering and Rhythm

Frequency of stuttering: Several subjects were eliminated because of the non availability of sufficient number of fluent samples in all the target units. Also, several longer units were eliminated for lack of sufficient number of subjects fluent in these longer target items Of particular interest would be the reexamination of the speech samples obtained from the subjects in the present study and determine the frequency of stuttering as a function of foot size. If the frequency of stuttering is in fact greater for larger units, then it is likely that the use of a more familiar (or the preferred) rhythmic pattern will result in ease of production. This issue directly raises the question of effects of adaptation on the speech of stutterers.

Until now, it is believed that through practice and familiarity of the phonetic contexts, fluency could be expected in stutterers. However, if stutterers are indeed relatively more fluent on certain rhythmic pattern than others, then the question is whether the effect of adaptation observed in stutterers is in fact due to familiarity of rhythmic

pattern. This question can be easily verified by manipulating the phonetic contexts and the stress pattern independently.

Rate and Relative timing: The present study shows that, at slower than normal rates stutterers can maintain the rhythm of speech. We need to obtain data from perceptual experiments, using normal speakers, to determine an optimal rate at which stress contrasts can be perceived and integrated perceptually as rhythmic patterns. Prior to treatment stutterers seem to have a faster rate of speech compared to normals, hence the rationale for teaching strategies to reduce their rate of speech in order to induce fluency. It would be interesting to investigate whether stutterers use faster rate of speech to maintain the relative timing between components.

In the present study, with the exception of two subjects, all the other stutterers had undergone treatment. Although these two subjects did not differ from the group in any significant manner, in order to understand whether the rhythm of stutterers' speech is different from normals (or disrupted), a replication of the present study with stutterers who have not undergone treatment would be in order. Such a study will also verify whether stuttering is indeed a "disorder of rhythm" as described by several researchers in the field of stuttering.

In addition, the investigation of "rhythm" in the speech of stutterers from different therapeutic programs will assist in the identification of these strategies that will facilitate fluency with no or minimal effect on the rhythm of speech.

Lastly, stutterers' fluent utterances have been judged by listeners (e.g., Prosek and Runyan, 1982) and found to be distinguishable from normal fluent utterances. In view of the findings of the present study, it would be valuable to correlate listener judgements of "rhythm" on fluent speech of stutterers from various treatment programs with measurements on relative durations of components within rhythmic units. In other words, the perceptual ratings on rhythm should be correlated with objective acoustical measurements of duration.

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APPENDIX I - STIMULUS MATERIAL

NOTE: Measurements were made on units underlined with stress markings.

NARRATIVE PASSAGE

Few prehistoric animals could have captured the imagination so completely as have the flying reptiles known as the pterosaurs. Extinct for the sixty four million years that have passed since the end of the mesozoic era, these dragons of the air have nonetheless figured prominently in man's view of the distant past ever since Arthur Conan Doyle made them part of the "Lost World". For almost two centuries paleontologists have been puzzling over the fossil remains of the pterosaurs, and surely others have wondered how the pterosaurs solved the problems of powered flight. Hang-gliding enthusiasts might well be curious because the larger pterosaurs weighed as much as a hang-glider pilot. In 1830 Johann Wagler linked the pterosaurs to the extinct marine reptiles.

Until recently it was thought that pterosaurs with wingspans as great as eight meters represented the maximum size for flying animals. Nine years ago, however, Douglas A. Lawson discovered bones that were quite large. The radius, the forearm bone, measured almost three quarters of a meter long. No additional remains of this animal, named after the Aztec god who took the form of a feathered serpent, have come to light since then.

EXTRACT FROM RADIO PLAY

John: He should have posted it.

Head: How much do you know about it, man?

John: Wittering. I simply don't believe it.

Inspector: Then it's news to you , sir?

John: News? Of course it is.

Inspector: He seems to infer that you were present while he was being bullied.

John: Does he?

Inspector: They were on at me worse than ever, even with the new master.

Head: And where were you?

John: Was I where?

Head: With them in the garage?

John: Oh no. I wasn't with them. I stood far away watching.

Inspector: You are quite sure of that, sir.

Head: Mind you, inspector, it's a highly hysterical letter.

Inspector: These sort of things generally are.

Head: All that rubbish about killing Mr.Pelham.

Inspector: Yes, sir, I'm sure a word or two with the boys will clear that up.

Head: It's so fantastic I should hardly have thought it worth troubling about.

Inspector: I'd like to speak to them though, sir.

Head: Yes, of course. I'll take you along to them now.

Inspector: I'd rather see them individually, if you don't mind, sir.

Head: One by one? They could be dangerous!

Inspector: Please sir.

Head: Are'nt you perhaps making rather much of this?

Inspector: I don't think so, sir. I can easily see them down at the station.

Head: Oh no, no. Much better to see them here.

Inspector: Do you know of other witnesses?

John: Yes. Christopher and Bob. They told me about other happenings as well.

RHYTHMIC UNITS IN SPECIAL SENTENCES (RUSS)

The credit proved to be a mixed blessing.

The creditor approved the contract.

However, Credit disapproved of the loan.

The credit approved was insufficient.

The creditor disapproved of our plans.

He credibly proved his point.

The management creditably approved the plan.

The point was credibly disproved by John.

The management creditably disapproved of the takeover.

This creditor disproved the point.

The creditor proved to be stubborn.

He creditably proved his point.

The point was creditably proved by John.

NOTE: Measurements were made on units underlined with stress markings.

APPENDIX II - PROGRAM FOR AUTOMATIC SEGMENTATION

SAMPLING OF SPEECH

```
CLEAR ALL
LABEL 1
DATA Y
DATA T
DATA SEG*8
READ *TTY &SEG
SET NTH=32
SET FREQ=8
SET SDIAL=3
SET SCROLL=ON
LABEL 0
CONTROL TR:PLAY
IF #SS:5 EQ 1 GOTO 0
SAMPLE
CONTROL TR:STOP


P
ED
LABEL 2
LOCK
WAIT 3SEC
IF #SS:1 EQ 1 PCURSE
IF #SS:2 EQ 1 PLAY
IF #SS:0 EQ 1 GOTO 2
EX &SEG
RETURN


QUE &SEG
MEAS DUR &Y &T
PRINT &Y &T
SET FMODE=ON
CALP
APH ON
SET FREQ=1
WAIT 5SEC
PLAY


WAIT 1SEC
DWA &SEG
GOTO 1 END
```

SIGNAL EDITING

```
PR SENSE SWITCH 1 PLAYS WHOLE SIGNAL
```

```
        SENSE SWITCH 0 PLAYS BETWEEN CURSORS
PR BEFORE YOU FINISH LAST SEGMENT, PRESS SENSE SWITCH 3

DATA Y
DATA T
DATA SEG=8
LABEL 0
PR GIVE ME SEGMENT NAME
READ *TTY &SEG
SET NTH =64


C   SIGNAL EXTRACTION AND DURATION MEASUREMENTS
    EDITOR
    LABEL 1
    LOCK
    WAIT 3SEC
    IF #SS:0 EQ 1 PCURSE
    IF #SS:1 EQ 1 PLAY
    IF #SS:5 EQ 0 GOTO 1
    EX &SEG
    RETURN


    QUE &SEG
    MEASURE DUR &Y &T
    PRINT &Y &T
    SINK NUMBER *OUT
    WRITE *OUT &SEG &Y &T
    PLAY


    SET FMODE=ON
    SET TP=8
    CALP
    PLOT 0 950 125
    DWA &SEG
    QUE SAM
    IF #SS:3 EQ 1 LINK SIG
    GOTO 0
    END
```

RETREIVAL OF SIGNAL FROM DISK

```
    CLEAR ALL
    SET VI=600
    DATA X 0
    DATA Y 16
    $SYS GET 5 0 0 0


    SAMPLE
    PR GIVE ME DISK STARTING BLOCK NUMBER
    READ *TTY &X
    LABEL 0
    $SYS READ &X 20 0 &Y
```

```
ADD &X 16


PRINT &X &Y
ADD &Y 8
IF &Y LE 56 GOTO 0
SCALE 1000 511
PLAY
PR NOW YOU HAVE SIGNAL. PRESS SENSE SWITCH 3
LABEL 2
IF #SS:3 EQ 1 LINK G1
GOTO 2
END
```

APPENDIX III - BMDP PROGRAMS FOR ANOVA

ANOVA PROGRAM FOR ISI

```
/PROBLEM    TITLE IS 'FOOT MEASUREMENTS'.
/INPUT      VARIABLES ARE 16. FORMAT IS FREE.
            MTSFILE IS GDAT3.
/VARIABLE   NAMES ARE F1T1,F1T2,F1T3,F1T4,
            F2T1,F2T2,F2T3,F2T4,
            F3T1,F3T2,F3T3,F3T4,
            F4T1,F4T2,F4T3,F4T4.
/DESIGN     LEVELS ARE 2,9,4,4.
            NAMES ARE  G,S,F,T.
            FIXED ARE G,F.
            RANDOM IS S,T.
            MODEL IS 'G,S(G),F,T(GSF)'.
            PRINT='GSTF'.
/END
```

ANOVA PROGRAM FOR 1USV AND TUSV

```
/PROBLEM        TITLE IS 'TIME MEASURE ALL'.
/INPUT          VARIABLES ARE 32. FORMAT IS FREE.
                MTSFILE IS 'GDAT3A'.
/VARIABLE       NAMES ARE
                F2T1US,F2T1UST,
                F2T2US,F2T2UST,
                F2T3US,F2T3UST,
                F2T4US,F2T4UST,
                F3T1US,F3T1UST,
                F3T2US,F3T2UST,
                F3T3US,F3T3UST,
                F3T4US,F3T4UST,
                F4T1US,F4T1UST,
                F4T2US,F4T2UST,
                F4T3US,F4T3UST,
                F4T4US,F4T4UST,
                F5T1US,F5T1UST,
                F5T2US,F5T2UST,
                F5T3US,F5T3UST,
                F5T4US,F5T4UST.
/DESIGN         LEVELS ARE 2,9,4,4.
                NAMES  ARE G,S,F,T.
                FIXED  ARE G,F.
                RANDOM IS  S,T.
                MODEL  IS  'G,S(G),F,T(GSF)'.
                PRINT  = 'GSTF'.
                NDEP   =  2.
/END
```

ANOVA PROGRAM FOR SV AND IVI

```
/PROBLEM        TITLE IS 'TIME MEASURE ON TWO'.
/INPUT          VARIABLES ARE 40. FORMAT IS FREE.
                MTSFILE IS 'GDAT3B'.
/VARIABLE       NAMES ARE
                F1T1SV,F1T1IV,
                F1T2SV,F1T2IV,
                F1T3SV,F1T3IV,
                F1T4SV,F1T4IV,
                F2T1SV,F2T1IV,
                F2T2SV,F2T2IV,
                F2T3SV,F2T3IV,
                F2T4SV,F2T4IV,
                F3T1SV,F3T1IV,
                F3T2SV,F3T2IV,
                F3T3SV,F3T3IV,
                F3T4SV,F3T4IV,
                F4T1SV,F4T1IV,
                F4T2SV,F4T2IV,
                F4T3SV,F4T3IV,
                F4T4SV,F4T4IV,
                F5T1SV,F5T1IV,
                F5T2SV,F5T2IV,
                F5T3SV,F5T3IV,
                F5T4SV,F5T4IV,
/DESIGN         LEVELS ARE 2,9,5,4.
                NAMES  ARE G,S,F,T.
                FIXED  ARE G,F.
                RANDOM IS  S,T.
                MODEL  IS  'G,S(G),F,T(GSF)'.
                PRINT  = 'GSTF'.
                NDEP   =  2.
/END
```

APPENDIX IV - CELL AND MARGINAL MEANS

MEANS FOR INTERSTRESS INTERVALS

GRAND MEAN 451.59722

CELL AND MARGINAL MEANS

G =	1	2
	508.86806	394.32639

F =	1	2	3	4
	258.76389	410.33333	489.30556	647.98611

	S = 1	2	3	4	5
G = 1	421.250	540.8125	547.3125	486.75	545.9375
2	408.125	390.0620	390.4375	348.50	355.5625

	S= 6	7	8	9
G = 1	643.56250	559.25000	434.18750	400.75000
2	455.06250	389.00000	434.43750	377.75000

	F = 1	2	3	4
G = 1	278.44444	455.11111	553.16667	748.75000
2	239.08333	365.55556	425.44444	547.22222

G = 1

F =	1	2	3	4
S = 1	270.00000	402.00000	396.00000	617.00000
2	281.00000	497.00000	641.25000	744.00000
3	213.00000	489.00000	541.25000	946.00000
4	324.00000	397.00000	544.00000	682.00000
5	252.00000	521.00000	522.75000	888.00000
6	363.00000	509.00000	745.25000	957.00000
7	333.00000	530.00000	629.25000	744.75000
8	238.00000	381.00000	486.75000	631.00000
9	232.00000	370.00000	472.00000	529.00000

G = 2

F =	1	2	3	4
S = 1	227.00000	372.00000	498.50000	535.00000
2	238.00000	355.00000	405.25000	562.00000
3	244.00000	377.00000	390.75000	550.00000
4	222.00000	315.00000	376.00000	481.00000
5	233.00000	343.00000	348.00000	498.25000
6	281.00000	428.00000	466.25000	645.00000
7	220.75000	327.00000	472.25000	536.00000
8	252.00000	421.00000	478.75000	586.00000
9	234.00000	352.00000	393.25000	531.75000

G = 1 S = 1

	T =	1	2	3	4
F =	1	288.00000	288.00000	320.00000	184.00000
	2	352.00000	576.00000	340.00000	340.00000
	3	396.00000	288.00000	508.00000	392.00000
	4	756.00000	544.00000	536.00000	632.00000

G = 1 S = 2

	T =	1	2	3	4
F =	1	288.00000	244.00000	316.00000	276.00000
	2	568.00000	504.00000	416.00000	500.00000
	3	641.00000	800.00000	660.00000	464.00000
	4	952.00000	680.00000	708.00000	636.00000

G = 1 S = 3

	T =	1	2	3	4
F =	1	188.00000	224.00000	292.00000	148.00000
	2	732.00000	452.00000	388.00000	384.00000
	3	541.00000	432.00000	712.00000	480.00000
	4	1128.00000	1420.00000	600.00000	636.00000

G = 1 S = 4

	T =	1	2	3	4
F =	1	328.00000	344.00000	356.00000	268.00000
	2	460.00000	304.00000	372.00000	452.00000
	3	544.00000	544.00000	532.00000	556.00000
	4	792.00000	724.00000	660.00000	552.00000

G = 1 S = 5

	T =	1	2	3	4
F =	1	220.00000	272.00000	316.00000	200.00000
	2	564.00000	660.00000	416.00000	444.00000
	3	523.00000	456.00000	680.00000	432.00000
	4	1072.00000	932.00000	924.00000	624.00000

G = 1 S = 6

	T =	1	2	3	4
F =	1	420.00000	400.00000	380.00000	252.00000
	2	544.00000	484.00000	492.00000	516.00000
	3	745.00000	580.00000	824.00000	832.00000
	4	1048.00000	692.00000	764.00000	1324.00000

G = 1 S = 7

	T =	1	2	3	4
F =	1	356.00000	416.00000	304.00000	256.00000
	2	704.00000	448.00000	464.00000	504.00000
	3	629.00000	564.00000	716.00000	608.00000
	4	868.00000	736.00000	655.00000	720.00000

G = 1 S = 8

	T =	1	2	3	4
F =	1	224.00000	268.00000	268.00000	192.00000
	2	444.00000	392.00000	260.00000	428.00000
	3	487.00000	524.00000	548.00000	388.00000
	4	684.00000	584.00000	532.00000	724.00000

G = 1 S = 9

T =	1	2	3	4
F = 1	236.00000	292.00000	208.00000	192.00000
2	368.00000	324.00000	400.00000	388.00000
3	472.00000	484.00000	552.00000	380.00000
4	616.00000	612.00000	472.00000	416.00000

G = 2 S = 1

T =	1	2	3	4
F = 1	224.00000	224.00000	268.00000	192.00000
2	368.00000	344.00000	328.00000	448.00000
3	498.00000	568.00000	512.00000	416.00000
4	524.00000	624.00000	544.00000	448.00000

G = 2 S = 2

T =	1	2	3	4
F = 1	200.00000	248.00000	252.00000	252.00000
2	340.00000	348.00000	396.00000	336.00000
3	405.00000	432.00000	448.00000	336.00000
4	596.00000	616.00000	580.00000	456.00000

G = 2 S = 3

T =	1	2	3	4
F = 1	196.00000	276.00000	288.00000	216.00000
2	424.00000	344.00000	312.00000	428.00000
3	391.00000	348.00000	436.00000	388.00000
4	576.00000	616.00000	588.00000	420.00000

G = 2 S = 4

T =	1	2	3	4
F = 1	196.00000	232.00000	240.00000	220.00000
2	320.00000	216.00000	324.00000	400.00000
3	376.00000	380.00000	388.00000	360.00000
4	544.00000	552.00000	456.00000	372.00000

G = 2 S = 5

T =	1	2	3	4
F = 1	208.00000	224.00000	284.00000	216.00000
2	328.00000	356.00000	300.00000	388.00000
3	348.00000	344.00000	384.00000	316.00000
4	593.00000	524.00000	492.00000	384.00000

G = 2 S = 6

T =	1	2	3	4
F = 1	260.00000	340.00000	304.00000	220.00000
2	404.00000	528.00000	348.00000	432.00000
3	466.00000	396.00000	480.00000	523.00000
4	680.00000	652.00000	680.00000	568.00000

G = 2 S = 7

T =	1	2	3	4
F = 1	187.00000	276.00000	232.00000	188.00000
2	324.00000	296.00000	328.00000	360.00000

3	472.00000	568.00000	464.00000	385.00000
4	576.00000	544.00000	516.00000	508.00000

G = 2 S = 8

T =	1	2	3	4
F = 1	216.00000	300.00000	308.00000	184.00000
2	432.00000	396.00000	436.00000	420.00000
3	479.00000	420.00000	600.00000	416.00000
4	652.00000	596.00000	528.00000	568.00000

G = 2 S = 9

T =	1	2	3	4
F = 1	204.00000	252.00000	248.00000	232.00000
2	388.00000	292.00000	344.00000	384.00000
3	393.00000	316.00000	496.00000	368.00000
4	568.00000	531.00000	528.00000	500.00000

MEANS FOR FIRST UNSTRESSED VOWELS

GRAND MEAN 58.51389

CELL AND MARGINAL MEANS

G =	1	2
	68.24306	48.78472

F =	1	2	3	4
	55.77778	69.33333	60.94444	48.00000

S =	1	2	3	4	5
G = 1	41.6875	75.4375	83.2500	61.5625	80.9375
2	40.9375	43.0625	48.5625	43.5625	54.7500

S =	6	7	8	9
G = 1	59.50000	49.43750	54.75000	44.50000
2	77.25000	69.25000	61.25000	63.56250

F =	1	2	3	4
G = 1	64.00000	78.97222	72.22222	57.77778
2	47.55556	59.69444	49.66667	38.22222

G = 1

F =	1	2	3	4
S = 1	42.00000	42.75000	50.00000	32.00000
2	83.00000	90.75000	72.00000	56.00000
3	75.00000	72.00000	86.00000	100.00000
4	58.00000	81.25000	55.00000	52.00000
5	69.00000	90.75000	116.00000	48.00000

6	69.00000	100.00000	68.00000	72.00000
7	61.00000	76.00000	76.00000	64.00000
8	57.00000	68.00000	64.00000	56.00000
9	62.00000	89.25000	63.00000	40.00000

G = 2

S = F =	1	2	3	4
1	39.00000	54.75000	46.00000	24.00000
2	52.00000	41.25000	55.00000	24.00000
3	35.00000	65.25000	50.00000	44.00000
4	42.00000	45.25000	47.00000	40.00000
5	47.00000	76.00000	48.00000	48.00000
6	72.00000	76.00000	50.00000	40.00000
7	40.00000	66.75000	47.00000	44.00000
8	57.00000	60.00000	54.00000	48.00000
9	44.00000	52.00000	50.00000	32.00000

G = 1 S = 1

F = T =	1	2	3	4
1	36.00000	40.00000	36.00000	56.00000
2	43.00000	32.00000	44.00000	52.00000
3	36.00000	60.00000	32.00000	72.00000
4	32.00000	32.00000	32.00000	32.00000

G = 1 S = 2

F = T =	1	2	3	4
1	68.00000	100.00000	112.00000	52.00000
2	91.00000	116.00000	88.00000	68.00000
3	48.00000	92.00000	36.00000	112.00000
4	56.00000	56.00000	56.00000	56.00000

G = 1 S = 3

F = T =	1	2	3	4
1	64.00000	140.00000	60.00000	36.00000
2	72.00000	84.00000	64.00000	68.00000
3	72.00000	80.00000	64.00000	128.00000
4	100.00000	100.00000	100.00000	100.00000

G = 1 S = 4

F = T =	1	2	3	4
1	56.00000	80.00000	64.00000	32.00000
2	81.00000	104.00000	60.00000	80.00000
3	40.00000	68.00000	32.00000	80.00000
4	52.00000	52.00000	52.00000	52.00000

G = 1 S = 5

F = T =	1	2	3	4
1	76.00000	100.00000	60.00000	40.00000
2	91.00000	104.00000	96.00000	72.00000
3	80.00000	204.00000	36.00000	144.00000
4	48.00000	48.00000	48.00000	48.00000

G = 1 S = 6

T =	1	2	3	4

F =	1	52.00000	128.00000	56.00000	40.00000
	2	100.00000	80.00000	152.00000	68.00000
	3	40.00000	88.00000	36.00000	108.00000
	4	72.00000	72.00000	72.00000	72.00000

G = 1 S = 7

	T =	1	2	3	4
F =	1	76.00000	104.00000	36.00000	28.00000
	2	76.00000	56.00000	84.00000	88.00000
	3	52.00000	88.00000	36.00000	128.00000
	4	64.00000	64.00000	64.00000	64.00000

G = 1 S = 8

	T =	1	2	3	4
F =	1	52.00000	112.00000	36.00000	28.00000
	2	68.00000	72.00000	72.00000	60.00000
	3	40.00000	60.00000	36.00000	120.00000
	4	56.00000	56.00000	56.00000	56.00000

G = 1 S = 9

	T =	1	2	3	4
F =	1	44.00000	108.00000	52.00000	44.00000
	2	89.00000	104.00000	112.00000	52.00000
	3	64.00000	76.00000	28.00000	84.00000
	4	40.00000	40.00000	40.00000	40.00000

G = 2 S = 1

	T =	1	2	3	4
F =	1	24.00000	68.00000	32.00000	32.00000
	2	55.00000	60.00000	48.00000	56.00000
	3	40.00000	40.00000	32.00000	72.00000
	4	24.00000	24.00000	24.00000	24.00000

G = 2 S = 2

	T =	1	2	3	4
F =	1	40.00000	68.00000	48.00000	52.00000
	2	41.00000	36.00000	48.00000	40.00000
	3	52.00000	60.00000	28.00000	80.00000
	4	24.00000	24.00000	24.00000	24.00000

G = 2 S = 3

	T =	1	2	3	4
F =	1	36.00000	56.00000	24.00000	24.00000
	2	65.00000	52.00000	76.00000	68.00000
	3	36.00000	64.00000	32.00000	68.00000
	4	44.00000	44.00000	44.00000	44.00000

G = 2 S = 4

	T =	1	2	3	4
F =	1	40.00000	72.00000	28.00000	28.00000
	2	45.00000	48.00000	52.00000	36.00000
	3	44.00000	68.00000	28.00000	48.00000
	4	40.00000	40.00000	40.00000	40.00000

G = 2 S = 5

T =	1	2	3	4
F = 1	56.00000	64.00000	28.00000	40.00000
2	76.00000	44.00000	136.00000	48.00000
3	56.00000	60.00000	24.00000	52.00000
4	48.00000	48.00000	48.00000	48.00000

G = 2 S = 6

T =	1	2	3	4
F = 1	52.00000	136.00000	52.00000	48.00000
2	76.00000	56.00000	76.00000	96.00000
3	60.00000	80.00000	36.00000	24.00000
4	40.00000	40.00000	40.00000	40.00000

G = 2 S = 7

T =	1	2	3	4
F = 1	36.00000	56.00000	40.00000	28.00000
2	67.00000	76.00000	76.00000	48.00000
3	36.00000	64.00000	28.00000	60.00000
4	44.00000	44.00000	44.00000	44.00000

G = 2 S = 8

T =	1	2	3	4
F = 1	68.00000	68.00000	28.00000	64.00000
2	60.00000	52.00000	68.00000	60.00000
3	40.00000	64.00000	24.00000	88.00000
4	48.00000	48.00000	48.00000	48.00000

G = 2 S = 9

T =	1	2	3	4
F = 1	32.00000	88.00000	24.00000	32.00000
2	52.00000	40.00000	64.00000	52.00000
3	44.00000	72.00000	16.00000	68.00000
4	32.00000	32.00000	32.00000	32.00000

MEANS FOR TOTAL UNSTRESSED VOWELS

GRAND MEAN 174.40278

CELL AND MARGINAL MEANS

G =	1	2
	199.19444	149.61111

F =	1	2	3	4
	55.77778	124.94444	213.33333	303.55556

S =	1	2	3	4	5

G =	1	131.3125	209.7500	210.5625	196.875	231.0000
	2	131.2500	148.0625	143.4375	139.750	152.1875

	S =	6	7	8	9
G =	1	207.87500	179.68750	215.43750	210.25000
	2	193.18750	151.50000	156.56250	130.56250

	F =	1	2	3	4
G =	1	64.00000	141.88889	237.55556	353.33333
	2	47.55556	108.00000	189.11111	253.77778

G = 1

	F =	1	2	3	4
S =	1	42.00000	89.25000	182.00000	212.00000
	2	83.00000	156.00000	244.00000	356.00000
	3	75.00000	133.25000	222.00000	412.00000
	4	58.00000	138.50000	227.00000	364.00000
	5	69.00000	168.00000	339.00000	348.00000
	6	69.00000	190.50000	236.00000	336.00000
	7	61.00000	114.75000	243.00000	300.00000
	8	57.00000	134.75000	210.00000	460.00000
	9	62.00000	152.00000	235.00000	392.00000

G = 2

	F =	1	2	3	4
S =	1	39.00000	104.00000	170.00000	212.00000
	2	52.00000	89.25000	199.00000	252.00000
	3	35.00000	110.75000	196.00000	232.00000
	4	42.00000	108.00000	173.00000	236.00000
	5	47.00000	118.75000	187.00000	256.00000
	6	72.00000	146.75000	222.00000	332.00000
	7	40.00000	116.00000	174.00000	276.00000
	8	57.00000	97.25000	208.00000	264.00000
	9	44.00000	81.25000	173.00000	224.00000

G = 1 S = 1

	T =	1	2	3	4
F =	1	36.00000	40.00000	36.00000	56.00000
	2	89.00000	72.00000	124.00000	72.00000
	3	204.00000	196.00000	172.00000	156.00000
	4	212.00000	212.00000	212.00000	212.00000

G = 1 S = 2

	T =	1	2	3	4
F =	1	68.00000	100.00000	112.00000	52.00000
	2	156.00000	208.00000	148.00000	112.00000
	3	220.00000	268.00000	248.00000	240.00000
	4	356.00000	356.00000	356.00000	356.00000

G = 1 S = 3

	T =	1	2	3	4
F =	1	64.00000	140.00000	60.00000	36.00000
	2	133.00000	148.00000	124.00000	128.00000
	3	256.00000	248.00000	168.00000	216.00000

4	412.00000	412.00000	412.00000	412.00000

G = 1 S = 4

T =	1	2	3	4
F = 1	56.00000	80.00000	64.00000	32.00000
2	114.00000	208.00000	112.00000	120.00000
3	276.00000	216.00000	168.00000	248.00000
4	364.00000	364.00000	364.00000	364.00000

G = 1 S = 5

T =	1	2	3	4
F = 1	76.00000	100.00000	60.00000	40.00000
2	168.00000	160.00000	188.00000	156.00000
3	344.00000	444.00000	300.00000	268.00000
4	348.00000	348.00000	348.00000	348.00000

G = 1 S = 6

T =	1	2	3	4
F = 1	52.00000	128.00000	56.00000	40.00000
2	190.00000	144.00000	304.00000	124.00000
3	260.00000	232.00000	212.00000	240.00000
4	336.00000	336.00000	336.00000	336.00000

G = 1 S = 7

T =	1	2	3	4
F = 1	76.00000	104.00000	36.00000	28.00000
2	115.00000	96.00000	128.00000	120.00000
3	236.00000	248.00000	200.00000	288.00000
4	300.00000	300.00000	300.00000	300.00000

G = 1 S = 8

T =	1	2	3	4
F = 1	52.00000	112.00000	36.00000	28.00000
2	135.00000	136.00000	176.00000	92.00000
3	248.00000	184.00000	196.00000	212.00000
4	460.00000	460.00000	460.00000	460.00000

G = 1 S = 9

T =	1	2	3	4
F = 1	44.00000	108.00000	52.00000	44.00000
2	152.00000	200.00000	176.00000	80.00000
3	272.00000	240.00000	212.00000	216.00000
4	392.00000	392.00000	392.00000	392.00000

G = 2 S = 1

T =	1	2	3	4
F = 1	24.00000	68.00000	32.00000	32.00000
2	104.00000	112.00000	124.00000	76.00000
3	116.00000	240.00000	152.00000	172.00000
4	212.00000	212.00000	212.00000	212.00000

G = 2 S = 2

T =	1	2	3	4
F = 1	40.00000	68.00000	48.00000	52.00000

2	89.00000	124.00000	80.00000	64.00000
3	188.00000	216.00000	212.00000	180.00000
4	252.00000	252.00000	252.00000	252.00000

G = 2 S = 3

T =	1	2	3	4
F = 1	36.00000	56.00000	24.00000	24.00000
2	111.00000	108.00000	128.00000	96.00000
3	192.00000	244.00000	200.00000	148.00000
4	232.00000	232.00000	232.00000	232.00000

G = 2 S = 4

T =	1	2	3	4
F = 1	40.00000	72.00000	28.00000	28.00000
2	108.00000	128.00000	116.00000	80.00000
3	208.00000	232.00000	124.00000	128.00000
4	236.00000	236.00000	236.00000	236.00000

G = 2 S = 5

T =	1	2	3	4
F = 1	56.00000	64.00000	28.00000	40.00000
2	119.00000	108.00000	176.00000	72.00000
3	176.00000	236.00000	176.00000	160.00000
4	256.00000	256.00000	256.00000	256.00000

G = 2 S = 6

T =	1	2	3	4
F = 1	52.00000	136.00000	52.00000	48.00000
2	147.00000	132.00000	148.00000	160.00000
3	264.00000	244.00000	224.00000	156.00000
4	332.00000	332.00000	332.00000	332.00000

G = 2 S = 7

T =	1	2	3	4
F = 1	36.00000	56.00000	40.00000	28.00000
2	116.00000	120.00000	160.00000	68.00000
3	184.00000	196.00000	148.00000	168.00000
4	276.00000	276.00000	276.00000	276.00000

G = 2 S = 8

T =	1	2	3	4
F = 1	68.00000	68.00000	28.00000	64.00000
2	97.00000	108.00000	104.00000	80.00000
3	220.00000	244.00000	156.00000	212.00000
4	264.00000	264.00000	264.00000	264.00000

G = 2 S = 9

T =	1	2	3	4
F = 1	32.00000	88.00000	24.00000	32.00000
2	81.00000	60.00000	120.00000	64.00000
3	176.00000	228.00000	116.00000	172.00000
4	224.00000	224.00000	224.00000	224.00000

MEANS FOR STRESSED VOWELS

GRAND MEAN 104.85833

CELL AND MARGINAL MEANS

G =	1	2
	113.53333	96.18333

F =	1	2	3	4	5
	126.6944	98.6666	121.8194	95.7777	81.3333

	S =	1	2	3	4	5
G =	1	99.20	126.400	91.650	127.600	114.25000
	2	94.65	88.450	91.050	79.850	107.20000

	S =	6	7	8	9
G =	1	135.45000	131.00000	98.95000	97.30000
	2	113.80000	88.25000	111.20000	91.20000

	F =	1	2	3	4	5
G =	1	135.388	103.888	134.9444	103.6666	89.7777
	2	118.000	93.444	108.6944	87.8888	72.8888

G = 1

	F =	1	2	3	4	5
S =	1	138.00	91.00	100.00	91.00	76.00
	2	138.00	116.00	148.00	126.00	104.00
	3	107.00	104.00	113.25	82.00	52.00
	4	159.00	107.00	152.00	112.00	108.00
	5	119.00	109.00	145.25	122.00	76.00
	6	194.00	112.00	153.25	114.00	104.00
	7	130.00	126.00	168.00	119.00	112.00
	8	113.00	93.00	118.75	78.00	92.00
	9	120.50	77.00	116.00	89.00	84.00

G = 2

	F =	1	2	3	4	5
S =	1	104.00	81.00	125.250	87.00	76.00
	2	113.00	74.00	97.250	82.00	76.00
	3	121.00	81.00	105.250	68.00	80.00
	4	103.00	73.00	81.250	82.00	60.00
	5	122.00	115.00	116.000	103.00	80.00
	6	142.00	130.00	104.000	117.00	76.00
	7	105.00	82.00	113.250	73.00	68.00
	8	130.00	111.00	144.000	95.00	76.00
	9	122.00	94.00	92.000	84.00	64.00

G = 1 S = 1

T =	1	2	3	4

F =	1	136.00000	96.00000	224.00000	96.00000
	2	64.00000	132.00000	60.00000	108.00000
	3	100.00000	84.00000	136.00000	80.00000
	4	160.00000	40.00000	60.00000	104.00000
	5	76.00000	76.00000	76.00000	76.00000

G = 1 S = 2

T =		1	2	3	4
F =	1	176.00000	100.00000	156.00000	120.00000
	2	136.00000	132.00000	76.00000	120.00000
	3	148.00000	92.00000	236.00000	116.00000
	4	224.00000	68.00000	72.00000	140.00000
	5	104.00000	104.00000	104.00000	104.00000

G = 1 S = 3

T =		1	2	3	4
F =	1	80.00000	80.00000	120.00000	148.00000
	2	152.00000	120.00000	52.00000	92.00000
	3	113.00000	100.00000	120.00000	120.00000
	4	160.00000	52.00000	44.00000	72.00000
	5	52.00000	52.00000	52.00000	52.00000

G = 1 S = 4

T =		1	2	3	4
F =	1	192.00000	160.00000	140.00000	144.00000
	2	128.00000	136.00000	64.00000	100.00000
	3	152.00000	164.00000	148.00000	144.00000
	4	228.00000	52.00000	76.00000	92.00000
	5	108.00000	108.00000	108.00000	108.00000

G = 1 S = 5

T =		1	2	3	4
F =	1	136.00000	104.00000	156.00000	80.00000
	2	112.00000	140.00000	84.00000	100.00000
	3	145.00000	140.00000	220.00000	76.00000
	4	212.00000	72.00000	72.00000	132.00000
	5	76.00000	76.00000	76.00000	76.00000

G = 1 S = 6

T =		1	2	3	4
F =	1	196.00000	280.00000	184.00000	116.00000
	2	124.00000	152.00000	60.00000	112.00000
	3	153.00000	128.00000	220.00000	112.00000
	4	212.00000	60.00000	56.00000	128.00000
	5	104.00000	104.00000	104.00000	104.00000

G = 1 S = 7

T =		1	2	3	4
F =	1	172.00000	116.00000	112.00000	120.00000
	2	152.00000	152.00000	76.00000	124.00000
	3	168.00000	168.00000	212.00000	124.00000
	4	228.00000	52.00000	56.00000	140.00000
	5	112.00000	112.00000	112.00000	112.00000

G = 1 S = 8

T =	1	2	3	4
F = 1	108.00000	100.00000	124.00000	120.00000
2	112.00000	108.00000	72.00000	80.00000
3	119.00000	148.00000	116.00000	92.00000
4	128.00000	32.00000	60.00000	92.00000
5	92.00000	92.00000	92.00000	92.00000

G = 1 S = 9

T =	1	2	3	4
F = 1	136.00000	112.00000	120.00000	114.00000
2	100.00000	88.00000	60.00000	60.00000
3	116.00000	112.00000	136.00000	100.00000
4	160.00000	56.00000	60.00000	80.00000
5	84.00000	84.00000	84.00000	84.00000

G = 2 S = 1

T =	1	2	3	4
F = 1	124.00000	84.00000	124.00000	84.00000
2	72.00000	96.00000	44.00000	112.00000
3	125.00000	160.00000	128.00000	88.00000
4	160.00000	32.00000	52.00000	104.00000
5	76.00000	76.00000	76.00000	76.00000

G = 2 S = 2

T =	1	2	3	4
F = 1	124.00000	100.00000	128.00000	100.00000
2	72.00000	96.00000	48.00000	80.00000
3	97.00000	100.00000	136.00000	56.00000
4	140.00000	44.00000	60.00000	84.00000
5	76.00000	76.00000	76.00000	76.00000

G = 2 S = 3

T =	1	2	3	4
F = 1	112.00000	112.00000	120.00000	140.00000
2	100.00000	96.00000	32.00000	96.00000
3	105.00000	88.00000	132.00000	96.00000
4	124.00000	28.00000	28.00000	92.00000
5	80.00000	80.00000	80.00000	80.00000

G = 2 S = 4

T =	1	2	3	4
F = 1	92.00000	88.00000	108.00000	124.00000
2	72.00000	76.00000	40.00000	104.00000
3	81.00000	80.00000	64.00000	100.00000
4	168.00000	52.00000	32.00000	76.00000
5	60.00000	60.00000	60.00000	60.00000

G = 2 S = 5

T =	1	2	3	4
F = 1	152.00000	88.00000	128.00000	120.00000
2	120.00000	156.00000	60.00000	124.00000
3	116.00000	148.00000	108.00000	92.00000
4	200.00000	48.00000	48.00000	116.00000

5	80.00000	80.00000	80.00000	80.00000

G = 2 S = 6

T =	1	2	3	4
F = 1	144.00000	168.00000	132.00000	124.00000
2	144.00000	200.00000	64.00000	112.00000
3	104.00000	128.00000	104.00000	80.00000
4	156.00000	52.00000	60.00000	200.00000
5	76.00000	76.00000	76.00000	76.00000

G = 2 S = 7

T =	1	2	3	4
F = 1	100.00000	124.00000	112.00000	84.00000
2	88.00000	100.00000	52.00000	88.00000
3	113.00000	156.00000	80.00000	104.00000
4	132.00000	44.00000	40.00000	76.00000
5	68.00000	68.00000	68.00000	68.00000

G = 2 S = 8

T =	1	2	3	4
F = 1	128.00000	124.00000	160.00000	108.00000
2	104.00000	152.00000	68.00000	120.00000
3	144.00000	144.00000	156.00000	132.00000
4	172.00000	56.00000	44.00000	108.00000
5	76.00000	76.00000	76.00000	76.00000

G = 2 S = 9

T =	1	2	3	4
F = 1	132.00000	112.00000	112.00000	132.00000
2	92.00000	108.00000	72.00000	104.00000
3	92.00000	96.00000	84.00000	96.00000
4	152.00000	32.00000	56.00000	96.00000
5	64.00000	64.00000	64.00000	64.00000

MEANS FOR INTERVOWEL INTERVAL

GRAND MEAN 308.09444

CELL AND MARGINAL MEANS

G =	1	2
	368.67222	247.51667

F =	1	2	3	4	5
	133.402	256.388	242.027	338.875	569.7777

S =	1	2	3	4	5
G = 1	270.35	337.45	616.90	340.25	345.25000

	2	278.05	258.70	236.95	239.15	194.70000

	S =	6	7	8	9
G =	1	443.25000	375.05000	288.85000	300.70000
	2	237.35000	248.15000	274.45000	260.15000

	F =	1	2	3	4	5
G =	1	144.722	288.222	275.333	407.527	727.555
	2	122.083	224.555	208.722	270.222	412.000

G = 1

	F =	1	2	3	4	5
S =	1	132.00	269.00	206.75	344.000	400.000
	2	143.00	297.00	337.25	374.000	536.000
	3	121.00	311.00	294.50	642.000	1716.000
	4	165.00	232.00	245.25	343.000	716.000
	5	133.00	353.00	209.25	427.000	604.000
	6	169.00	327.00	401.25	607.000	712.000
	7	203.00	343.00	346.50	382.750	600.000
	8	125.00	231.00	233.25	343.000	512.000
	9	111.50	231.00	204.00	205.000	752.000

G = 2

	F =	1	2	3	4	5
S =	1	123.00	252.00	269.25	278.00	468.00
	2	125.00	229.00	218.50	281.00	440.00
	3	123.00	261.00	174.75	286.00	340.00
	4	119.00	200.00	186.75	226.00	464.00
	5	111.00	181.00	113.25	208.25	360.00
	6	139.00	226.00	215.75	306.00	300.00
	7	115.75	205.00	243.00	289.00	388.00
	8	131.00	253.00	237.25	283.00	468.00
	9	112.00	214.00	220.00	274.75	480.00

G = 1 S = 1

	T =	1	2	3	4
F =	1	152.00000	192.00000	96.00000	88.00000
	2	252.00000	404.00000	244.00000	176.00000
	3	207.00000	132.00000	248.00000	240.00000
	4	392.00000	308.00000	304.00000	372.00000
	5	400.00000	400.00000	400.00000	400.00000

G = 1 S = 2

	T =	1	2	3	4
F =	1	112.00000	144.00000	160.00000	156.00000
	2	364.00000	268.00000	228.00000	328.00000
	3	337.00000	500.00000	276.00000	236.00000
	4	508.00000	344.00000	388.00000	256.00000
	5	536.00000	536.00000	536.00000	536.00000

G = 1 S = 3

	T =	1	2	3	4
F =	1	108.00000	144.00000	172.00000	60.00000
	2	520.00000	192.00000	276.00000	256.00000

	3	294.00000	184.00000	468.00000	232.00000
	4	712.00000	1120.00000	388.00000	348.00000
	5	1716.00000	1716.00000	1716.00000	1716.00000

G = 1 S = 4

T =	1	2	3	4
F = 1	136.00000	184.00000	216.00000	124.00000
2	276.00000	88.00000	244.00000	320.00000
3	245.00000	172.00000	272.00000	292.00000
4	288.00000	456.00000	416.00000	212.00000
5	716.00000	716.00000	716.00000	716.00000

G = 1 S = 5

T =	1	2	3	4
F = 1	84.00000	168.00000	160.00000	120.00000
2	376.00000	420.00000	272.00000	344.00000
3	209.00000	156.00000	272.00000	200.00000
4	516.00000	416.00000	552.00000	224.00000
5	604.00000	604.00000	604.00000	604.00000

G = 1 S = 6

T =	1	2	3	4
F = 1	224.00000	120.00000	196.00000	136.00000
2	368.00000	204.00000	376.00000	360.00000
3	401.00000	308.00000	300.00000	596.00000
4	576.00000	400.00000	496.00000	956.00000
5	712.00000	712.00000	712.00000	712.00000

G = 1 S = 7

T =	1	2	3	4
F = 1	184.00000	300.00000	192.00000	136.00000
2	476.00000	192.00000	352.00000	352.00000
3	346.00000	300.00000	376.00000	364.00000
4	404.00000	436.00000	399.00000	292.00000
5	600.00000	600.00000	600.00000	600.00000

G = 1 S = 8

T =	1	2	3	4
F = 1	116.00000	168.00000	144.00000	72.00000
2	280.00000	172.00000	152.00000	320.00000
3	233.00000	240.00000	256.00000	204.00000
4	308.00000	368.00000	276.00000	420.00000
5	512.00000	512.00000	512.00000	512.00000

G = 1 S = 9

T =	1	2	3	4
F = 1	100.00000	180.00000	88.00000	78.00000
2	224.00000	128.00000	288.00000	284.00000
3	204.00000	172.00000	240.00000	200.00000
4	184.00000	316.00000	200.00000	120.00000
5	752.00000	752.00000	752.00000	752.00000

G = 2 S = 1

T =	1	2	3	4

F =	1	100.00000	140.00000	144.00000	108.00000
	2	272.00000	180.00000	252.00000	304.00000
	3	269.00000	296.00000	260.00000	252.00000
	4	248.00000	352.00000	340.00000	172.00000
	5	468.00000	468.00000	468.00000	468.00000

G = 2 S = 2

	T =	1	2	3	4
F =	1	76.00000	148.00000	124.00000	152.00000
	2	228.00000	184.00000	300.00000	204.00000
	3	218.00000	208.00000	232.00000	216.00000
	4	268.00000	356.00000	308.00000	192.00000
	5	440.00000	440.00000	440.00000	440.00000

G = 2 S = 3

	T =	1	2	3	4
F =	1	84.00000	164.00000	168.00000	76.00000
	2	288.00000	192.00000	256.00000	308.00000
	3	175.00000	152.00000	176.00000	196.00000
	4	260.00000	344.00000	360.00000	180.00000
	5	340.00000	340.00000	340.00000	340.00000

G = 2 S = 4

	T =	1	2	3	4
F =	1	104.00000	144.00000	132.00000	96.00000
	2	208.00000	68.00000	256.00000	268.00000
	3	187.00000	172.00000	208.00000	180.00000
	4	168.00000	268.00000	300.00000	168.00000
	5	464.00000	464.00000	464.00000	464.00000

G = 2 S = 5

	T =	1	2	3	4
F =	1	56.00000	136.00000	156.00000	96.00000
	2	152.00000	136.00000	212.00000	224.00000
	3	113.00000	88.00000	100.00000	152.00000
	4	217.00000	240.00000	268.00000	108.00000
	5	360.00000	360.00000	360.00000	360.00000

G = 2 S = 6

	T =	1	2	3	4
F =	1	116.00000	172.00000	172.00000	96.00000
	2	208.00000	192.00000	232.00000	272.00000
	3	216.00000	136.00000	228.00000	283.00000
	4	260.00000	356.00000	396.00000	212.00000
	5	300.00000	300.00000	300.00000	300.00000

G = 2 S = 7

	T =	1	2	3	4
F =	1	87.00000	152.00000	120.00000	104.00000
	2	200.00000	140.00000	236.00000	244.00000
	3	243.00000	292.00000	224.00000	213.00000
	4	260.00000	304.00000	328.00000	264.00000
	5	388.00000	388.00000	388.00000	388.00000

G = 2 S = 8

F =	T = 1	2	3	4
1	124.00000	176.00000	148.00000	76.00000
2	260.00000	176.00000	340.00000	236.00000
3	237.00000	168.00000	340.00000	204.00000
4	260.00000	296.00000	328.00000	248.00000
5	468.00000	468.00000	468.00000	468.00000

G = 2 S = 9

F =	T = 1	2	3	4
1	72.00000	140.00000	136.00000	100.00000
2	264.00000	96.00000	248.00000	248.00000
3	220.00000	160.00000	292.00000	208.00000
4	240.00000	271.00000	356.00000	232.00000
5	480.00000	480.00000	480.00000	480.00000

MEANS FOR RUSS FOR FIVE NORMALS

	F2	F3	F4	F5	F6
SV	94	87	85	80	76
1USV	74	65	58	52	64
TUSV	74	145	225	285	315
IVI	205	285	395	470	640
ISI	373	517	705	835	1031